



California Morbidity

AFRICANIZED HONEYBEES IN CALIFORNIA: PUBLIC HEALTH ASPECTS

This report provides an update on the presence of Africanized honeybees (AHBs) in California, on clinical manifestations and medical management of bee stinging victims, and on prevention measures. In 1957, African honeybees (*Apis mellifera scutellata*), imported to Brazil by a research institution, became feral and mated with established European honeybees (EHBs), resulting in the hybrid AHBs.¹ The "africanization" process has been expanding northward at a rate of 50-300 miles/year and now encompasses parts of Texas, New Mexico, Arizona, Nevada, and California. The milder winter and greater availability of floral resources associated with "El Niño" has likely favored and increased the potential for further expansion of AHBs into North America. Since their arrival in October 1994, AHBs have colonized large portions of Imperial, Riverside, San Bernardino, San Diego, and Los Angeles counties, almost tripling their colonized area in 1998 (Figure 1). There have been 19 confirmed AHB stinging incidents involving 34 people in California, with no fatalities yet. Incidents occurred (one each) in 1995 and 1996, two in 1997, and fifteen in 1998.

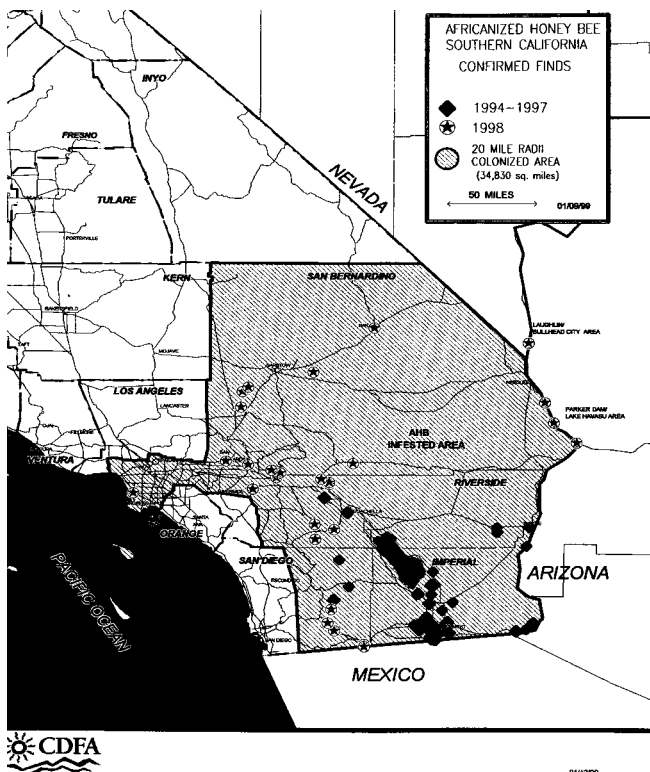


Figure 1. Areas colonized by Africanized honeybees in California as of September 14, 1998.

Map courtesy of the California Department of Food and Agriculture

AHBs and EHBs are grossly indistinguishable and individual bees can be differentiated only by morphometry² or analysis of mitochondrial DNA.³ However, AHBs have retained many of the behavioral traits of African bees that contribute to their public health significance.^{4,5} AHBs are easily agitated; even slight disturbances, such as movement, odors, or vibrations, may incite an AHB colony to attack in mass, thus distinguishing them from EHBs. AHBs are highly aggressive and, once disturbed, may pursue a victim for up to 0.6 miles and remain agitated for hours.¹ AHBs reproduce and swarm at an accelerated rate, significantly increasing their potential for range expansion. Finally, AHBs are relatively indiscriminate in their selection of nesting habitat and will establish colonies almost anyplace, including unprotected areas where they are easily disturbed.

Clinical manifestations

Both AHBs and EHBs die after stinging. The nature and potency of their venoms are similar.⁶ The higher morbidity and mortality associated with AHBs is due to the greater number of multiple stinging incidents.⁷ The LD₅₀ for honeybee venom is about 19 stings per kg⁸ (e.g., 1,300 stings for a 150-lbs. person). The approximate median number of stings which California AHB victims received has been 15 (range 1-500+). Children, the elderly, and individuals with severe underlying diseases are at increased risk because of their lower tolerance of toxins and/or reduced ability to escape a bee attack.⁴

Symptoms following bee stings vary from mild to severe, and can be classified into three major categories:

Local Pain, pruritus, erythema, urticaria, and angioedema may develop at the site of the sting and persist for several hours to a few days.⁹ Single stings to the mouth or neck can be life threatening because of breathing impairment. Dermal necrosis has been reported in a child who had more than 1000 stings.¹⁰

Anaphylaxis^{4,5,11}. Even a single sting can precipitate anaphylaxis in persons previously sensitized to bee venom --about 2% of the population.⁷ Symptoms are typical and may include widespread edema and urticaria, dizziness, vomiting, and diarrhea within 10-20 minutes of exposure. More severe symptoms include bronchospasm, laryngeal edema, dyspnea, hypotension (occasionally hypertension), arrhythmia, tachycardia, syncope, seizures, shock and death. Symptoms may exacerbate 6-24 hours after the initial reaction.¹² Also, a serum sickness-type reaction--with fever, angioedema, bronchospasm, joint swelling and arthralgia --may occur up to 2 weeks after the attack.^{11,13}

Systemic Multi-organ complications sometimes develop in response to large doses of venom from multiple stings.^{4,9,14} Initial toxic symptoms can resemble anaphylaxis but may also progress to myoglobinuria, hemoglobinuria, rhabdomyolysis, acute renal failure (ARF),^{10,15,16} hepatic dysfunction,¹⁶ myocardial damage, cerebral and pulmonary edema,¹⁵ or acute hemorrhagic pancreatitis,¹⁷ up to 10 days after the sting.⁵ Laboratory abnormalities, including elevated WBC (up to 25,000/mm³), occasional anemia, thrombocytopenia and disseminated intravascular coagulation may signal developing systemic complications.^{4,15} Serum creatine phosphokinase (CPK) levels appear to be a more sensitive marker of the amount of venom exposure, beginning to increase within hours of the stings and peaking in 2-5 days.

Medical management

Bee antivenin is not currently available, so medical management of AHB victims is entirely supportive and depends on the number of stings and clinical manifestations.⁴ Attached stingers should be removed promptly, preferably within 1-2 minutes after stinging, and the affected areas cleansed with soap and water.^{11,18} The method of removing stingers is less important than timeliness of their removal.^{18,19} An estimate of the amount of toxin the victim received may be made by tallying the number of stingers removed.⁴

In patients with a few stings and/or only a local reaction, topical and oral medications may be administered to reduce pain and swelling (e.g., ice packs, astringents, analgesics, antipruritics).⁴ Patients with multiple stings (especially children and the elderly) as well as those with an anaphylactic (or systemic toxic) reaction, should be hospitalized for observation and treatment. Most frequently, treatment includes topical medications, oral/intravenous fluids, antihistaminics (both H₁ and H₂ blockers), oxygen supplementation, corticosteroids and epinephrine (or glucagon, for patients on beta-blockers),^{4,11} with respiratory and cardiovascular support the principal objective. Other treatment occasionally recommended includes bronchodilator aerosols (e.g., albuterol solution), antiemetics, aminophylline, and/or endotracheal intubation.^{5,11} Laboratory evaluation should include CBC and differential, serum chemistry (including CPK) with electrolytes, arterial blood gases, urinalysis, ECG, thoracic radiography, and prothrombin time.⁴

Treatment of multiple sting victims represents a serious challenge because of limited medical information and experience, and specialty consultation is indicated. Physicians need to be particularly aware of the potential for AHB patients to experience severe allergic and toxic reactions, and for complications developing up to several days after the stinging incident.^{9,11} Patients should be monitored closely for up to two weeks, or until all laboratory work normalizes, following apparent clinical recovery. The most aggressive management for severe cases is plasmapheresis (or exchange transfusion) which helps to remove circulating venom and/or mediators of inflammation,¹⁴ especially if done within 48 hours of stinging. Haemodialysis, although less effective, is an alternative modality (within first 48 hours) if plasmapheresis is not available. Other treatment options include aggressive intravenous fluids (e.g., 0.9 normal saline as a 20 ml/kg bolus followed by mannitol 25 gm IV (0.5 gm/kg child)), epinephrine (IV push 0.1-1.0 ml of 1:10,000 over 5 minutes), and urine alkalization (in case of myoglobinuria). Diuretics may be considered in cases of pulmonary or cerebral edema.¹⁷ Dialysis has been recommended early in the treatment of ARF.^{14,15} For serum sickness, treatment includes systemic corticosteroids with antihistamines and analgesics.¹¹

Long-term sequelae to multiple stings are infrequent¹⁴ but may manifest as cutaneous symptoms, photosensitivity, fatigue, anorexia, or diarrhea. Consultation with an allergist for bee venom testing is indicated to determine the need to carry injectable epinephrine or use venom immunotherapy.⁴

Prevention

Although AHBs have been associated with numerous stinging incidents in humans in Latin America and USA, fatalities remain relatively rare.^{5,7} Unfortunately, earlier sensationalized media reports of massive bee attacks in Latin America have given AHBs their "killer" reputation and created unwarranted anxiety in the public.^{1,19} In fact, adequate preparation and prompt response can greatly reduce the number of serious stinging incidents and fatalities.^{1,4} Several measures can be taken by individuals to reduce their risk of AHBs.^{4,5,7}

- 1) Avoid direct contact with, and excessive motion or noise around, bee colonies. Never attempt to move or destroy feral beehives, but report their location to the authorities.

- 2) When outdoors near bee colonies, wear shoes, long pants, and long sleeves. Avoid wearing perfumes and keep pets on leash.

- 3) Eliminate sites for possible colonization including holes and defects in exterior walls and junk piles in yards. Inspect premises routinely to identify any new colonies.

- 4) Persons attacked by bees should immediately run for shelter, covering their face to prevent airway stings. Witnesses to a bee attack should immediately contact authorities and keep other people and pets away. Only trained personnel, wearing full protective gear, should attempt to rescue a victim when bees continue to swarm.

- 5) Persons with potential occupational exposure to AHBs (e.g., first emergency responders, landscapers, and park rangers) should have special training on this topic. All individuals with a history of systemic reactions to bee stings should consult an allergist to determine the need for venom immunotherapy and have continuous access to an anaphylaxis treatment kit.

To assist state and local agencies with surveillance and movement of AHBs, multiple stinging incidents should be reported to the County Agricultural Commissioner or the local health department. If possible, a sample of bees involved in the incident should be submitted to the County Agricultural Commissioner for identification.

As AHBs extend geographically in California, an increase in cases of allergic and toxic reactions to bee attacks can be expected. The future impact of AHBs on public health will depend chiefly on the frequency and intensity of contact with AHBs, the extent of public education on prevention methods and risks associated with AHBs, the availability and capacity of emergency response services and medical assistance, and the availability of trained AHB control teams to remove or destroy their hives.^{1,7}

References

1. Winston ML. Killer Bees, The Africanized Honeybee in the Americas. Harvard University Press, Cambridge, MA. 1992.
2. Sylvester HA, Rinderer TE. Fast Africanized bee identification system (FABIS) manual. *Am Bee J* 1987;127:511-16.
3. Crozier YC, Koullanos S, Crozier RH. An improved test for Africanized honeybee mitochondrial DNA. *Experientia*. 1991;47:968-9.
4. McKenna WR. Killer bees: What the allergist should know. *Ped Asthma, Allergy and Immunol* 1992;6:275-85.
5. Schumaker MJ. Significance of Africanized bees for public health. *Arch Intern Med* 1995;155:2038-43.
6. Schumaker MJ, Schmidt JO, Egen NB, Lowry JE. Quantity, analysis and lethality of European and Africanized honeybee venoms. *Am J Trop Med Hyg* 1992;43:79-86.
7. Sherman RA. What physicians should know about africanized honeybees. *West J Med* 1995;163:541-6.
8. Schmidt JO. Allergy to venom insects. In: Graham JM (Ed): *The Hive and the Honeybee*. Hamilton III. Dadant & Sons 1992; pp 1209-69.
9. Reisman RE. Insect stings. *New England J Med* 1994; 331(8):523-527.
10. Tumwine JK, Nkrumah FK. Acute renal failure and dermal necrosis due to bee stings: report of a case in a child. *Cent Afr J Med* 1990;36(8):202-4.
11. Kemp ED. Bites and stings of the arthropod kind. *Postgraduate Med* 1998;103(6): 88-106.
12. Golden DBK. Allergic reactions to insect stings. In: *Allergy, Asthma, and Immunology from Infancy to Adulthood*. Bierman CW, Peralman DS, Shapiro GG, Busse WW (ed.): 1996:348-54.
13. Lazoglu AH, Boglioli LR, Taff ML, et al. Serum sickness reaction following multiple insect stings. *Annals of allergy, Asthma and Immunol* 1995;75:522-4.
14. Diaz-Sanchez C, Lifshitz-Guinzbarg A, Ignacio-Ibarra G, et al. Survival after massive (>2000) africanized honeybee stings. *Arch Intern Med* 1998;158:925-7.
15. Franca FOS, Benvenuti LA, Fan HW, et al. Severe and fatal mass attacks by 'killer' bees (Africanized honeybees – *Apis mellifera scutellata*) in Brazil: clinicopathological studies with measurement of serum venom concentrations. *Quarterly J Med* 1994;87: 269-82.
16. Hommel D, Bollandard F, Hulin A. Multiple African honeybee stings and acute renal failure. *Nephron* 1998;78:235-6.
17. Daisley H. Acute haemorrhagic pancreatitis following multiple stings by Africanized bees in Trinidad. *Royal Soc Trop Med and Hygiene* 1998;92:71-2.
18. Schumaker MJ, Tveten MS, Egen NB. Rate and quantity of delivery of venom from honeybee stings. *J Allergy Clin Immunol* 1994; 93(5):831-5.
19. Vissher PK, Vetter RS, Camazine S. Removing bee stings. *The Lancet* 1996;348:301-2.
20. Nunamaker RA. Newspaper accounts of Africanized bees are designed to frighten people – Being stung by the press. *Am Bee J* 1979;119:587.

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